Final

Site Investigation Report
Former Smoke Area BVZ, Parcel 124(7)

Fort McClellan
Calhoun County, Alabama

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Executive Summary

In accordance with Contract Number DACA21-96-D-0018, Task Order CK05, IT Corporation (IT) completed a site investigation (SI) at Former Smoke Area BVZ, Parcel 124(7), at Fort McClellan in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site, and, if present, whether the concentrations present an unacceptable risk to human health or the environment. The SI at Former Smoke Area BVZ, Parcel 124(7), consisted of the sampling and analysis of two surface soil samples, two depositional soil samples, two subsurface soil samples, three surface water samples, and three sediment samples.

Chemical analyses of samples collected at Former Smoke Area BVZ, Parcel 124(7), indicate that metals, volatile organic compounds (VOC), and semivolatile organic compounds (SVOC) were detected in the various site media. To evaluate whether detected constituents pose an unacceptable risk to human health or the environment, analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for Fort McClellan.

The potential threat to human receptors is expected to be low. Although the site is projected for passive recreational use, the soils data were screened against residential human health SSSLs to evaluate the site for possible unrestricted future land use. In soils, the concentrations of four metals (aluminum, arsenic, iron, and manganese) exceeded SSSLs. With the exception of iron in one subsurface soil sample, the concentrations of these metals were below their respective background concentration or within the range of background values and do not pose an unacceptable risk to human health. VOC and SVOC concentrations in site media were below SSSLs.

The potential impact to ecological receptors is also expected to be minimal. Nine metals were detected in site media at concentrations exceeding ESVs. However, the concentrations of these metals were below their respective background concentration or within the range of background values and do not pose an unacceptable risk to the environment.

Two VOCs (1,2,3-trichloropropane and trichlorofluoromethane) were detected in sediments at Parcel 124(7) at concentrations exceeding ESVs. The compound 1,2,3-trichloropropane was detected in only one sample location at a concentration (0.11 milligrams per kilogram [mg/kg]) below the method reporting limit. The trichlorofluoromethane results (0.0032 mg/kg, 0.0059 mg/kg, and 0.0034 mg/kg) marginally exceeded the ESV (0.00307 mg/kg).

The concentrations of six SVOCs (bis[2-ethylhexyl]phthalate, chrysene, fluoranthene, naphthalene, phenanthrene, and pyrene) exceeded ESVs in sediment samples collected at the site. The bis(2-ethylhexyl)phthalate ESV exceedance was flagged with a 'B' data qualifier, suggesting that this compound is not site-related. The other five SVOCs that exceeded ESVs are polynuclear aromatic hydrocarbon (PAH) compounds that were detected in one sediment sample collected on the downstream side of Rock Hollow Road. This fact, coupled with the observation that these compounds were not detected in any of the other samples collected at the site, including two sediment samples collected upstream of Rock Hollow Road closer to the area of investigation, suggests these PAH compounds are not site-related.

Based on the results of the SI, past operations at Former Smoke Area BVZ, Parcel 124(7), do not appear to have adversely impacted the environment. The metals and chemical constituents detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, IT recommends "No Further Action" and unrestricted land reuse with regard to hazardous, toxic, and radioactive waste at Former Smoke Area BVZ, Parcel 124(7).

1.0 Introduction

The U.S. Army has selected Fort McClellan (FTMC) located in Calhoun County, Alabama, for closure by the Base Realignment and Closure (BRAC) Commission under Public Laws 100-526 and 101-510. The 1990 Base Closure Act, Public Law 101-510, established the process by which U.S. Department of Defense (DOD) installations would be closed or realigned. The BRAC Environmental Restoration Program requires investigation and cleanup of federal properties prior to transfer to the public domain. The U.S. Army is conducting environmental studies of the impact of suspected contaminants at parcels at FTMC under the management of the U.S. Army Corps of Engineers (USACE)-Mobile District. The USACE contracted with IT Corporation (IT) to perform the site investigation (SI) at Former Smoke Area BVZ, Parcel 124(7), under Contract Number DACA21-96-D-0018, Task Order CK05.

This SI report presents specific information and results compiled from the SI, including field sampling and analysis, conducted at Former Smoke Area BVZ, Parcel 124(7).

1.1 Project Description

Former Smoke Area BVZ was identified as an area to be investigated prior to property transfer. The site was classified as a Category 7 site in the environmental baseline survey (EBS) (Environmental Science and Engineering, Inc. [ESE], 1998). Category 7 sites are areas that are not evaluated or require further evaluation.

A site-specific field sampling plan (SFSP) attachment (IT, 1998a) and a site-specific safety and health plan (SSHP) attachment were finalized in October 1998. The SFSP and SSHP were prepared to provide technical guidance for sample collection and analysis at Former Smoke Area BVZ, Parcel 124(7). The SFSP was used in conjunction with the SSHP as attachments to the installation-wide work plan (IT, 1998b) and the installation-wide sampling and analysis plan (SAP) (IT, 2000a). The SAP includes the installation-wide safety and health plan and quality assurance plan.

The SI included fieldwork to collect two surface soil samples, two depositional soil samples, two subsurface soil samples, three surface water samples, and three sediment samples to determine whether potential site-specific chemicals are present at the site and to provide data useful for supporting any future corrective measures and closure activities.

1.2 Purpose and Objectives

The SI program was designed to collect data from site media and provide a level of defensible data and information in sufficient detail to determine whether chemical constituents are present at Former Smoke Area BVZ, Parcel 124(7), at concentrations that would present an unacceptable risk to human health or the environment. The conclusions of this report in Chapter 6.0 are based on a comparison of the analytical results to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for FTMC. The SSSLs and ESVs were developed by IT as part of the human health and ecological risk evaluations associated with SIs being performed under the BRAC Environmental Restoration Program at FTMC. The SSSLs and ESVs are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000b). Background metals screening values are presented in the *Final Background Metals Survey Report, Fort McClellan, Alabama* (Science Applications International Corporation [SAIC], 1998).

Based on the conclusions presented in this SI report, the BRAC Cleanup Team will decide either to propose "No Further Action" at the site or to conduct additional work at the site.

1.3 Site Description and History

Former Smoke Area BVZ is located in the central portion of the Main Post, between the developed area of the post and the Skeleton Mountains, in the southwest portion of Range 29 (Figure 1-1). The parcel covers approximately 1.3 acres. The site and surrounding area are mostly undeveloped or wooded. Activities at the site included the use of approximately 15 smoke generators and fog oil. The fog oil was stored in 55-gallon drums in an area measuring approximately 50 by 50 feet located at the fog line. Spills of fog oil reportedly occurred at the site. Smoke Area BVZ was used only when all other smoke ranges were occupied. The dates of its use could not be determined. There are no buildings or structures present at the site; however, pieces of cinder block and metal that may have been previously used as fog oil drum racks are visible around the site.

South Branch of Cane Creek, an intermittent stream, is located approximately 250 feet southwest of the site and flows to the northwest. The site is located on a steep, west-facing slope and is approximately 100 feet wide (east to west) and 500 feet in length (north to south). Site elevation is approximately 870 to 900 feet above mean sea level. Figure 1-2 is a site map that shows topographic features and site boundaries.

2.0 Previous Investigations

An EBS was conducted by ESE to document current environmental conditions of all FTMC property (ESE, 1998). The study was to identify sites that, based on available information, have no history of contamination and comply with DOD guidance for fast-track cleanup at closing installations. The EBS also provides a baseline picture of FTMC properties by identifying and categorizing the properties by seven criteria:

1. Areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas)

2. Areas where only release or disposal of petroleum products has occurred

3. Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial response

4. Areas where release, disposal, and/or migration of hazardous substances has occurred, and all removal or remedial actions to protect human health and the environment have been taken

5. Areas where release, disposal, and/or migration of hazardous substances has occurred, and removal or remedial actions are underway, but all required remedial actions have not yet been taken

6. Areas where release, disposal, and/or migration of hazardous substances has occurred, but required actions have not yet been implemented

7. Areas that are not evaluated or require additional evaluation.

The EBS was conducted in accordance with the Community Environmental Response Facilitation Act (CERFA) (CERFA-Public Law 102-426) protocols and DOD policy regarding contamination assessment. Record searches and reviews were performed on all reasonably available documents from FTMC, the Alabama Department of Environmental Management (ADEM), the U.S. Environmental Protection Agency (EPA) Region IV, and Calhoun County, as well as a database search of Comprehensive Environmental Response, Compensation, and Liability Act-regulated substances, petroleum products, and Resource Conservation and Recovery Act-regulated facilities. Available historical maps and aerial photographs were

reviewed to document historical land uses. Personal and telephone interviews of past and present FTMC employees and military personnel were conducted. In addition, visual site inspections were conducted to verify conditions of specific property parcels.

Former Smoke Area BVZ was identified as a CERFA Category 7 site: areas that are not evaluated or require further evaluation. Former Smoke Area BVZ lacked adequate documentation and therefore required evaluation to determine the environmental condition of the parcel. There have not been any other investigations identified for Former Smoke Area BVZ.

3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by IT at Former Smoke Area BVZ, Parcel 124(7), including unexploded ordnance (UXO) avoidance and environmental sampling and analysis activities.

3.1 UXO Avoidance

Because Former Smoke Area BVZ falls within the "Possible Explosive Ordnance Impact Area" (USACE, 1998), IT performed UXO avoidance at the site following methodology outlined in Section 4.1.7 of the SAP (IT, 2000a). IT UXO personnel used a Schonstedt Heliflux Magnetic Locator to perform a surface sweep of the parcel prior to site access. After the parcel was cleared for access, sample locations were cleared using a Foerster Ferex Electromagnetic Detector, following procedures outlined in Section 4.1.7.3 of the SAP (IT, 2000a).

3.2 Environmental Sampling

The environmental sampling performed during the SI at Former Smoke Area BVZ, Parcel 124(7), included the collection of surface and depositional soil samples, subsurface soil samples, and surface water and sediment samples for chemical and physical analyses. The sample locations were determined by observing site physical characteristics during a site walkover, by reviewing historical documents pertaining to activities conducted at the site, and based on UXO avoidance activities. The sample locations, media, and rationale are summarized in Table 3-1. Sampling locations are shown on Figure 3-1. Samples were submitted for laboratory analysis of site-related parameters listed in Section 3.4.

3.2.1 Surface and Depositional Soil Sampling

Surface soil samples were collected from two locations and depositional soil samples were collected from two locations at Former Smoke Area BVZ, Parcel 124(7), as shown on Figure 3-1. Soil sampling locations and rationale are presented in Table 3-1. Sample designations and quality assurance/quality control (QA/QC) samples are listed in Table 3-2. Soil sampling locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, site topography, and buried utilities.

Sample Collection. Surface and depositional soil samples were collected from the upper 1 foot of soil with a 3-inch diameter stainless-steel hand auger, using the methodology specified in

Section 4.9.1.1 of the SAP (IT, 2000a). Surface and depositional soil samples were collected by first removing surface debris, such as rocks or vegetation, from the immediate sample area. The soil was then collected with the sampling device and screened with a photoionization detector (PID) in accordance with Section 4.7.1.1 of the SAP (IT, 2000a). Samples for volatile organic compound (VOC) analysis were collected directly from the sampler using three EnCore® samplers. The remaining portion of the sample was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4. Sample collection logs are included in Appendix A.

3.2.2 Subsurface Soil Sampling

Subsurface soil samples were collected from two soil borings at Former Smoke Area BVZ, Parcel 124(7), as shown on Figure 3-1. Subsurface soil sampling locations and rationale are presented in Table 3-1. Subsurface soil sample designations, depths, and QA/QC samples are listed in Table 3-2. Soil boring sampling locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, site topography, and buried and overhead utilities. IT contracted TEG, Inc., a direct-push technology subcontractor, to assist in subsurface soil sample collection.

Sample Collection. Subsurface soil samples were collected from soil borings at depths greater than 1 foot below ground surface (bgs) in the unsaturated zone. The soil borings were advanced and soil samples collected using the direct-push sampling procedures specified in Section 4.9.1.1 of the SAP (IT, 2000a). Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.4.

Subsurface soil samples were collected continuously until direct-push sampler refusal was encountered. Samples were field-screened using a PID in accordance with Section 4.7.1.1 of the SAP (IT, 2000a) to measure for volatile organic vapors. The soil sample displaying the highest reading was selected and sent to the laboratory for analysis; however, at those locations where PID readings were not greater than background, the deepest soil sample interval above the saturated zone was submitted for analysis. Samples to be analyzed for VOCs were collected directly from the sampler using three EnCore® samplers. The remaining portion of the sample was transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. Samples submitted for laboratory analysis are summarized in Table 3-2. The

on-site geologist constructed a detailed boring log for each soil boring. The lithological log for each borehole is included in Appendix B.

At the completion of soil sampling, boreholes were abandoned with bentonite pellets and hydrated with potable water following borehole abandonment procedures summarized in Appendix B of the SAP (IT, 2000a).

3.2.3 Surface Water Sampling

Three surface water samples were collected at Former Smoke Area BVZ, Parcel 124(7), at the locations shown on Figure 3-1. The surface water sampling locations and rationale are listed in Table 3-1. Surface water sample designations and QA/QC samples are listed in Table 3-3. The sampling locations were determined in the field, based on drainage pathways and actual field observations.

Sample Collection. Surface water samples were collected in accordance with the procedures specified in Section 4.9.1.3 of the SAP (IT, 2000a). The surface water samples were collected by dipping a stainless-steel pitcher in the water and pouring the water into the sample containers or by dipping the sample containers in the water and allowing the water to fill the sample containers. Surface water samples were collected after field parameters had been measured using a calibrated water quality meter. Surface water field parameters are listed in Table 3-4. Sample collection logs are included in Appendix A. The samples were analyzed for the parameters listed in Table 3-3 using methods outlined in Section 3.4.

3.2.4 Sediment Sampling

Three sediment samples were collected at the same locations as the surface water samples presented in Section 3.2.3, as shown on Figure 3-1. Sediment sampling locations and rationale are presented in Table 3-1. The sediment sample designations are listed in Table 3-3. The actual sediment sampling locations were determined in the field, based on drainage pathways and actual field observations.

Sample Collection. Sediment samples were collected in accordance with the procedures specified in Section 4.9.1.2 of the SAP (IT, 2000a). Sediments were collected with a stainless-steel spoon and placed in a clean stainless-steel bowl. Samples for VOC analysis were then immediately collected from the stainless-steel bowl with three EnCore® samplers. The remaining portion of the sample was homogenized and placed in the appropriate sample containers. Sample

collection logs are included in Appendix A. The sediment samples were analyzed for the parameters listed in Table 3-3 using methods outlined in Section 3.4.

3.3 Surveying of Sample Locations

Sample locations were surveyed using global positioning system survey techniques described in Section 4.3 of the SAP (IT, 2000a) and conventional civil survey techniques described in Section 4.19 of the SAP (IT, 2000a). Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix C.

3.4 Analytical Program

Samples collected during the SI were analyzed for various chemical and physical parameters. The specific suite of analyses performed was based on the potential site-specific chemicals historically at the site and EPA, ADEM, FTMC, and USACE requirements. The samples collected at Former Smoke Area BVZ, Parcel 124(7), were analyzed for the following parameters:

- Target compound list VOCs – EPA Method 5035/8260B
- Target compound list semivolatile organic compounds (SVOC) – EPA Method 8270C
- Target analyte list metals – EPA Method 6010B/7000
- Total organic carbon (TOC) – EPA Method 9060 (sediment only)
- Grain size – American Society for Testing and Materials Method D421/D422 (sediment only).

The samples were analyzed using EPA SW-846 methods, including Update III methods where applicable, as presented in Table 6-1 in Appendix B of the SAP (IT, 2000a). Data were reported and evaluated in accordance with Corps of Engineers South Atlantic Savannah Level B criteria (USACE, 1994) and the stipulated requirements for the generation of definitive data (Section 3.1.2 of Appendix B of the SAP [IT, 2000a]). Chemical data were reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms. These packages were validated in accordance with EPA National Functional Guidelines by Level III criteria. A

summary of validated analytical data is included in Appendix D. The Data Validation Summary Report is included as Appendix E.

3.5 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping followed requirements specified in Section 4.13.2 of the SAP (IT, 2000a). Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SI are listed in Chapter 5.0, Table 5-1, of Appendix B of the SAP (IT, 2000a). Sample documentation and chain-of-custody records were recorded as specified in Section 4.13 of the SAP (IT, 2000a).

Completed analysis request and chain-of-custody records (Appendix A) were secured and included with each shipment of sample coolers to Quanterra Environmental Services in Knoxville, Tennessee. Split samples were shipped to the USACE South Atlantic Division Laboratory in Marietta, Georgia.

3.6 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in Appendix D of the SAP (IT, 2000a). The IDW generated during the SI at Former Smoke Area BVZ, Parcel 124(7), was segregated as follows:

- Soil boring cuttings
- Personal protective equipment
- Decontamination fluids.

Solid IDW was stored inside the fenced area surrounding Buildings T-335 and T-336 in lined roll-off bins prior to characterization and final disposal. Solid IDW was characterized using toxicity characteristic leaching procedure analyses. Based on the results, soil boring cuttings and personal protective equipment generated during the SI were disposed as nonregulated waste at the Industrial Waste Landfill on the Main Post of FTMC.

Liquid IDW was contained in the existing 20,000-gallon sump associated with the Building T-338 vehicle washrack. Liquid IDW was characterized by VOC, SVOC, and metals analyses. Based on the analyses, liquid IDW was discharged as nonregulated waste to the FTMC wastewater treatment plant on the Main Post.

3.7 Variances/Nonconformances

There were not any variances or nonconformances to the SFSP recorded during completion of the SI at Former Smoke Area BVZ, Parcel 124(7).

3.8 Data Quality

The field sample analytical data are presented in tabular form in Appendix D. The field samples were collected, documented, handled, analyzed, and reported in a manner consistent with the SI work plan; the FTMC SAP and quality assurance plan; and standard, accepted methods and procedures. Sample collection logs pertaining to the collection of these samples were reviewed and organized for this report and are included in Appendix A.

Data Validation. A complete (100 percent) Level III data validation effort was performed on the reported analytical data. Appendix E consists of a data validation summary report that was prepared to discuss the results of the validation. Selected results were rejected or otherwise qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the report. The validation-assigned qualifiers were added to the FTMC IT Environmental Management System™ database for tracking and reporting. The qualified data were used in the comparison to the SSSLs and ESVs. Rejected data (assigned an 'R' qualifier) were not used in the comparison to the SSSLs and ESVs.

The data presented in this report, except where qualified, meet the principle data quality objective for this SI.

4.0 Site Characterization

Subsurface investigations performed at Former Smoke Area BVZ, Parcel 124(7), provided soil data used to characterize the geology of the site. Because there were not any wells installed at the site, a hydrogeological characterization was not performed.

4.1 Regional and Site Geology

4.1.1 Regional Geology

Calhoun County includes parts of two physiographic provinces, the Piedmont Upland Province and the Valley and Ridge Province. The Piedmont Upland Province occupies the extreme eastern and southeastern portions of the county and is characterized by metamorphosed sedimentary rocks. The generally accepted range in age of these metamorphics is Cambrian to Devonian.

The majority of Calhoun County, including the Main Post of FTMC, lies within the Appalachian fold-and-thrust structural belt (Valley and Ridge Province) where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold-and-thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted, with major structures and faults striking in a northeast-southwest direction.

Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the imbricate stacking of large slabs of rock referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault, resulting in imbricate stacking of rock units within an individual thrust sheet (Osborne and Szabo, 1984). Geologic contacts in this region generally strike parallel to the faults, and repetition of lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992), and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group consists of the Cochran, Nichols, Wilson Ridge, and Weisner Formations (Osborne and Szabo, 1984) but in Calhoun County is either undifferentiated or divided into the Cochran and Nichols Formations and an upper undifferentiated Wilson Ridge and Weisner Formation. The Cochran is composed of poorly sorted arkosic sandstone and

conglomerate with interbeds of greenish-gray siltstone and mudstone. Massive to laminated greenish-gray and black mudstone makes up the Nichols Formation, with thin interbeds of siltstone and very fine-grained sandstone (Szabo et al., 1988). These two formations are mapped only in the eastern part of the county.

The Wilson Ridge and Weisner Formations are undifferentiated in Calhoun County and consist of both coarse-grained and fine-grained clastics. The coarse-grained facies appear to dominate the unit and consists primarily of coarse-grained, vitreous quartzite, and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consists of sandy and micaceous shale and silty, micaceous mudstone which are locally interbedded with the coarse clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of FTMC belongs to the Weisner Formation (Osborne and Szabo, 1984).

The Cambrian Shady Dolomite overlies the Weisner Formation northeast, east and southwest of the Main Post and consists of interlayered bluish-gray or pale yellowish-gray sandy dolomitic limestone and siliceous dolomite with coarsely crystalline porous chert (Osborne et al., 1989). A variegated shale and clayey silt have been included within the lower part of the Shady Dolomite (Cloud, 1966). Material similar to this lower shale unit was noted in core holes drilled by the Alabama Geologic Survey on FTMC (Osborne and Szabo, 1984). The character of the Shady Dolomite in the FTMC vicinity and the true assignment of the shale at this stratigraphic interval are still uncertain (Osborne, 1999).

The Rome Formation overlies the Shady Dolomite and locally occurs to the northwest and southeast of the Main Post as mapped by Warman and Causey (1962) and Osborne and Szabo (1984), and immediately to the west of Reilly Airfield (Osborne and Szabo, 1984). The Rome Formation consists of variegated, thinly interbedded grayish-red-purple mudstone, shale, siltstone, and greenish-red and light gray sandstone, with locally occurring limestone and dolomite. The Conasauga Formation overlies the Rome Formation and occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey, 1962), (Osborne and Szabo, 1984) and the northern portion of the Main Post (Osborne et al., 1997). The Conasauga Formation is composed of dark-gray, finely to coarsely crystalline medium- to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in Calhoun County and consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weather to a chert residuum (Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone is comprised of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped together as undifferentiated at FTMC and other parts of Calhoun County. The Athens Shale overlies the Ordovician limestone units. The Athens Shale consists of dark-gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989). These units occur within an eroded "window" in the uppermost structural thrust sheet at FTMC and underlie much of the developed area of the Main Post.

Other Ordovician-aged bedrock units mapped in Calhoun County include the Greensport Formation, Colvin Mountain Sandstone, and Sequatchie Formation. These units consist of various siltstones, sandstones, shales, dolomites and limestones, and are mapped as one, undifferentiated unit in some areas of Calhoun County. The only Silurian-age sedimentary formation mapped in Calhoun County is the Red Mountain Formation. This unit consists of interbedded red sandstone, siltstone, and shale with greenish-gray to red silty and sandy limestone.

The Devonian Frog Mountain Sandstone consists of sandstone and quartzitic sandstone with shale interbeds, dolomudstone, and glauconitic limestone (Szabo et al., 1988). This unit locally occurs in the western portion of Pelham Range.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of dark- to light-gray limestone with abundant chert nodules and greenish-gray to grayish-red phosphatic shale, with increasing amounts of calcareous chert toward the upper portion of the formation (Osborne and Szabo, 1984). These units occur in the northwestern portion of Pelham Range. Overlying the Fort Payne Chert is the Floyd Shale, also

of Mississippian age, which consists of thin-bedded, fissile brown to black shale with thin intercalated limestone layers and interbedded sandstone. Osborne and Szabo (1984) reassigned the Floyd Shale, which was mapped by Warman and Causey (1962) on the Main Post of FTMC, to the Ordovician Athens Shale on the basis of fossil data.

The Jacksonville Thrust Fault is the most significant structural geologic feature in the vicinity of FTMC, both for its role in determining the stratigraphic relationships in the area and for its contribution to regional water supplies. The trace of the fault extends northeastward for approximately 39 miles between Bynum, Alabama and Piedmont, Alabama. The fault is interpreted as a major splay of the Pell City Fault (Osborne and Szabo, 1984). The Ordovician sequence that makes up the Eden thrust sheet is exposed at FTMC through an eroded "window," or "fenster," in the overlying thrust sheet. Rocks within the window display complex folding, with the folds being overturned and tight to isoclinal. The carbonates and shales locally exhibit well-developed cleavage (Osborne and Szabo, 1984). The FTMC window is framed on the northwest by the Rome Formation, north by the Conasauga Formation, northeast, east, and southwest by the Shady Dolomite, and southeast and southwest by the Chilhowee Group (Osborne et al., 1997).

4.1.2 Site Geology

Two soil types are mapped at Former Smoke Area BVZ: the Anniston and Allen Stony Loams and Anniston and Allen Gravelly Loams. The surface soil of the Anniston and Allen Stony Loam is generally dark brown to grayish brown in color. The subsurface soil consists of a dark red to reddish brown stony, fine sand, clay, loam. The Anniston and Allen Gravelly Loam consists of friable soils that have developed in old alluvium on the foot slopes and fan along the base of mountains. The color of the surface soil ranges from dark brown to reddish brown, and the subsurface soil is generally a reddish-brown clay loam to clay or silty clay loam (U.S. Department of Agriculture, 1961).

Bedrock beneath Former Smoke Area BVZ is mapped as the undifferentiated Ordovician Little Oak and Newala Limestones (Osborne et al., 1997). The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone consists of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules (Osborne et al., 1989).

Based on direct-push soil boring data collected during the SI, the soils at Parcel 124(7) consist of two distinct units: a yellowish to reddish-brown gravelly, silty, clay surface soil underlain by a reddish-brown cobbley, sandy, silty, clay subsurface soil. The descriptions of the soil from the direct-push borings are consistent with the mapped soils. Bedrock was not encountered during the direct-push activities. Direct-push refusal occurred between 4 to 6 feet below ground surface.

4.2 Site Hydrology

Precipitation in the form of rainfall averages about 54 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1998). The major surface water features on the Main Post of FTMC include Remount Creek, Cane Creek, South Branch of Cane Creek, and Cave Creek. These waterways flow in a general northwest to westerly direction towards the Coosa River on the western boundary of Calhoun County.

Parcel 124(7) is located on a steep, west-facing slope. South Branch of Cane Creek is located approximately 250 feet southwest of the site and flows to the northwest. Surface drainage at the site follows topography and flows to the west-northwest toward South Branch of Cane Creek.

5.0 Summary of Analytical Results

The results of chemical analyses of the samples collected at Former Smoke Area BVZ, Parcel 124(7), indicate that metals, VOCs, and SVOCs were detected in the various site media. To evaluate whether the detected constituents present an unacceptable risk to human health and the environment, analytical results were compared to the human health SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC.

Metals concentrations exceeding the SSSLs and ESVs were subsequently compared to metals background screening values (background concentrations) (SAIC, 1998) to determine if the metals concentrations are within natural background concentrations. Summary statistics for background metals samples collected at FTMC (SAIC, 1998) are included in Appendix F.

Six compounds were quantified by both SW-846 Method 8260B (as VOC) and Method 8270C (as SVOC), namely, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 1,3-dichlorobenzene, 1,2-dichlorobenzene, hexachlorobutadiene, and naphthalene. Method 8260B yields a reporting limit (RL) of 0.005 milligrams per kilogram (mg/kg), while Method 8270C has a RL of 0.330 mg/kg, which is typical for a soil matrix sample. Due to the direct nature of the Method 8260B analysis and its resulting lower RL, this method should be considered superior to Method 8270C when quantifying low levels (0.005 to 0.330 mg/kg) of these compounds. Method 8270C and its associated methylene chloride extraction step is superior, however, when dealing with samples that contain higher concentrations (greater than 0.330 mg/kg) of these compounds. Therefore, all data were considered, and none were categorically excluded. Data validation qualifiers were helpful in evaluating the usability of data, especially if calibration, blank contamination, precision, or accuracy indicator anomalies were encountered. The validation qualifiers and concentrations reported (e.g., whether concentrations were less than or greater than 0.330 mg/kg) were used to determine which analytical method was likely to return the more nearly accurate result.

The following sections and Tables 5-1 through 5-4 summarize the results of the comparison of detected constituents to the SSSLs, ESVs, and background screening values. Complete analytical results are presented in Appendix D.

5.1 Surface and Depositional Soil Analytical Results

Two surface soil samples and two depositional soil samples were collected for chemical analysis at Former Smoke Area BVZ, Parcel 124(7). Surface and depositional soil samples were collected from the upper 1 foot of soil at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs, ESVs, and metals background concentrations, as presented in Table 5-1.

Metals. Eighteen metals were detected in surface and depositional soil samples collected at Former Smoke Area BVZ, Parcel 124(7). The concentrations of four metals (aluminum, arsenic, iron, and manganese) exceeded SSSLs. However, the concentrations of these metals were below their respective background concentration.

The concentrations of eight metals (aluminum, chromium, iron, lead, manganese, selenium, vanadium, and zinc) exceeded ESVs in surface and depositional soil samples collected at Parcel 124(7). With the exception of lead (FTA-124-GP01), selenium (FTA-124-GP01), and zinc (FTA-124-DEP02) in one sample each, the metals concentrations were below their respective background concentration. However, the zinc, lead, and selenium results were within the range of background values determined by SAIC (1998) (Appendix F).

Volatile Organic Compounds. Seven VOCs (2-butanone, acetone, bromomethane, cumene, methylene chloride, naphthalene, and toluene) were detected in surface and depositional soil samples collected at Parcel 124(7). Acetone (FTA-124-DEP01 and FTA-124-GP01), bromomethane (FTA-124-GP01), cumene (FTA-124-DEP01), naphthalene (FTA-124-GP01), and toluene (FTA-124-GP01) results were flagged with a 'J' data qualifier, indicating that the results were greater than the method detection limit (MDL) but less than the RL. Acetone (FTA-124-GP02), 2-butanone (FTA-124-DEP01 and FTA-124-GP01), and methylene chloride (all sample locations) results were flagged with a 'B' data qualifier, signifying that these compounds were also detected in an associated laboratory or field blank. Acetone and methylene chloride are common laboratory contaminants.

The VOC concentrations in surface and depositional soils were below SSSLs and ESVs.

Semivolatile Organic Compounds. Bis(2-ethylhexyl)phthalate was the only detected SVOC in surface and depositional soil samples collected at Parcel 124(7). The bis(2-

ethylhexyl)phthalate result from FTA-124-DEP02 was flagged with a 'J' data qualifier, indicating that the result was greater than the MDL but less than the RL. The remaining bis(2-ethylhexyl)phthalate results were flagged with a 'B' data qualifier, signifying that the compound was also detected in an associated laboratory or field blank. Bis(2-ethylhexyl)phthalate is a common laboratory contaminant.

The bis(2-ethylhexyl)phthalate concentrations were below the SSSL and ESV.

5.2 Subsurface Soil Analytical Results

Two subsurface soil samples were collected for chemical analysis at Former Smoke Area BVZ, Parcel 124(7). Subsurface soil samples were collected at depths greater than 1 foot bgs at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background concentrations, as presented in Table 5-2.

Metals. Seventeen metals were detected in subsurface soil samples collected at Parcel 124(7). The concentrations of five metals (aluminum, arsenic, chromium, iron, and manganese) exceeded SSSLs. Of these metals, the concentrations of arsenic (FTA-124-GP01), iron (FTA-124-GP01), and manganese (FTA-124-GP02) also exceeded their respective background concentration. With the exception of the iron result, the concentrations of these metals were within the range of background values determined by SAIC (1998) (Appendix F).

Volatile Organic Compounds. Three VOCs (acetone, bromomethane, and methylene chloride) were detected in subsurface soil samples collected at Parcel 124(7). The acetone result at FTA-124-GP02 and bromomethane results from FTA-124-GP01 were flagged with a 'J' data qualifier, indicating that the result was greater than the MDL but less than the RL. The methylene chloride results and one of the acetone results were flagged with a 'B' data qualifier, signifying that these compounds were also detected in an associated laboratory or field blank. Acetone and methylene chloride are common laboratory contaminants.

The VOC concentrations in subsurface soils were below SSSLs.

Semivolatile Organic Compounds. Two SVOCs (di-n-butyl phthalate and bis[2-ethylhexyl]phthalate) were detected in subsurface soil samples collected at Parcel 124(7). The di-n-butyl phthalate result from FTA-124-GP01 was flagged with a 'J' data qualifier, indicating

that the result was greater than the MDL but less than the RL. The bis(2-ethylhexyl)phthalate results were flagged with a 'B' data qualifier, signifying that the compound was also detected in an associated laboratory or field blank. Bis(2-ethylhexyl)phthalate is a common laboratory contaminant.

The di-n-butyl phthalate and bis(2-ethylhexyl)phthalate concentrations in subsurface soils were below SSSLs.

5.3 Surface Water Analytical Results

Three surface water samples were collected for chemical analysis at Former Smoke Area BVZ, Parcel 124(7), at the locations shown on Figure 3-1. Analytical results were compared to recreational site user human health SSSLs, ESVs, and metals background concentrations, as presented in Table 5-3.

Metals. Eight metals were detected in the surface water samples collected at Parcel 124(7). The aluminum, iron, manganese, and sodium results were flagged with a 'B' data qualifier, signifying that these metals were also detected in an associated laboratory or field blank sample. The remaining metals results were flagged with a 'J' data qualifier indicating that the results were greater than the MDL but less than the RL.

The metals concentrations in surface water were below SSSLs. The concentrations of aluminum and barium exceeded ESVs in each of the samples but were below their respective background concentrations.

Volatile Organic Compounds. VOCs were not detected in the surface water samples collected at Former Smoke Area BVZ, Parcel 124(7).

Semivolatile Organic Compounds. One SVOC (butyl benzyl phthalate) was detected in two of the surface water samples (FTA-124-SW/SD01 and FTA-124-SW/SD02) collected at the site. The butyl benzyl phthalate results were flagged with a 'J' data qualifier, indicating that the results were greater than the MDL but less than the RL.

The butylbenzyl phthalate concentrations were below the SSSL and ESV.

5.4 Sediment Analytical Results

Three sediment samples were collected for chemical and physical analyses at Former Smoke Area BVZ, Parcel 124(7). Sediment samples were collected from the upper 1 foot of sediment at the locations shown on Figure 3-1. Analytical results were compared to recreational site user human health SSSLs, ESVs, and metals background concentrations, as presented in Table 5-4.

Metals. Nineteen metals were detected in each of the three sediment samples collected at Parcel 124(7). The arsenic, mercury, and sodium results, and two of the chromium results were flagged with a 'B' data qualifier, signifying that these metals were also detected in an associated laboratory or field blank sample.

The metals concentrations in sediments were below SSSLs and ESVs.

Volatile Organic Compounds. Eight VOCs (1,1,2-trichloroethane, 1,2,3-trichloropropane, 1,2-dichloroethane, 1,2-dimethylbenzene, acetone, cumene, methylene chloride, and trichlorofluoromethane) were detected in sediment samples collected at Parcel 124(7). The 1,2,3-trichloropropane, 1,2-dichloroethane, 1,2-dimethylbenzene, cumene, and trichlorofluoromethane results were flagged with a 'J' data qualifier, indicating that the results were greater than the MDL but less than the RL. The acetone and methylene chloride results were flagged with a 'B' data qualifier, signifying that these compounds were also detected in an associated laboratory or field blank. Acetone and methylene chloride are common laboratory contaminants.

The VOC concentrations in sediments were below SSSLs. The concentrations of 1,2,3-trichloropropane (FTA-124-SW/SD02) and trichlorofluoromethane (all three sample locations) exceeded ESVs.

Semivolatile Organic Compounds. Seventeen SVOCs, including, thirteen polynuclear aromatic hydrocarbon (PAH) compounds, were detected in sediment samples collected at Parcel 124(7). The bis(2-ethylhexyl)phthalate results were flagged with a 'B' data qualifier, signifying that the compound was also detected in an associated laboratory or field blank. In addition, bis(2-ethylhexyl)phthalate was the only detected SVOC at two locations (FTA-124-SW/SD01 and FTA-124-SW/SD02). All 17 of the detected SVOCs were present in the sample collected at FTA-124-SW/SD03.

The SVOC concentrations in sediments were below SSSLs. The concentrations of five PAH compounds (chrysene, fluoranthene, naphthalene, phenanthrene, and pyrene) at sample location FTA-124-SW/SD03 and one SVOC (bis[2-ethylhexyl]phthalate) at sample location FTA-124-SW/SD01 exceeded ESVs.

Total Organic Carbon. The sediment samples were analyzed for TOC content. TOC concentrations ranged from 2,140 to 12,300 mg/kg in the sediment samples. The TOC results are summarized in Appendix D.

Grain Size. The results of grain size analysis for sediment samples are included in Appendix D.

6.0 Summary, Conclusions, and Recommendations

IT, under contract with USACE, completed an SI at Former Smoke Area BVZ, Parcel 124(7), at FTMC in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site at concentrations that present an unacceptable risk to human health or the environment. The SI at Former Smoke Area BVZ, Parcel 124(7), consisted of the sampling and analysis of two surface soil samples, two depositional soil samples, two subsurface soil samples, three surface water samples, and three sediment samples.

Chemical analysis of samples collected at Former Smoke Area BVZ, Parcel 124(7), indicates that metals, VOCs, and SVOCs were detected in the various site media. Analytical results were compared to the human health SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by IT for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC. Additionally, metal concentrations exceeding SSSLs and ESVs were compared to media-specific background screening values (SAIC, 1998).

The potential threat to human receptors is expected to be low. Although the site is projected for passive recreational use (FTMC, 1997), the soils data were screened against residential human health SSSLs to evaluate the site for possible unrestricted future land use. In soils, the concentrations of four metals (aluminum, arsenic, iron, and manganese) exceeded SSSLs. With the exception of iron in one subsurface soil sample, the concentrations of these metals were below their respective background concentration or within the range of background values determined by SAIC (1998) and, thus, do not pose an unacceptable risk to human health. VOC and SVOC concentrations in site media were below SSSLs.

The potential impact to ecological receptors is also expected to be minimal. Nine metals were detected in site media at concentrations exceeding ESVs. However, the concentrations of these metals were below their respective background concentration or within the range of background values determined by SAIC (1998) and do not pose an unacceptable risk to the environment.

Two VOCs (1,2,3-trichloropropane and trichlorofluoromethane) were detected in sediments at concentrations exceeding ESVs. The compound 1,2,3-trichloropropane was detected in only one sample location at a concentration (0.11 mg/kg) below the RL. The trichlorofluoromethane

results (0.0032 mg/kg, 0.0059 mg/kg, and 0.0034 mg/kg) marginally exceeded the ESV (0.00307 mg/kg).

The concentrations of six SVOCs (bis[2-ethylhexyl]phthalate, chrysene, fluoranthene, naphthalene, phenanthrene, and pyrene) exceeded ESVs in sediment samples collected at the site. The bis(2-ethylhexyl)phthalate ESV exceedance was flagged with a 'B' data qualifier, suggesting that this compound is not site-related. The other five SVOCs that exceeded ESVs are PAH compounds that were detected in one sediment sample collected on the downstream side of Rock Hollow Road. This fact, coupled with the observation that these compounds were not detected in any of the other samples collected at the site, including two sediment samples collected upstream of Rock Hollow Road closer to the area of investigation, suggests these PAH compounds are not site-related.

Based on the results of the SI, past operations at Former Smoke Area BVZ, Parcel 124(7), do not appear to have adversely impacted the environment. The metals and chemical constituents detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, IT recommends "No Further Action" and unrestricted land reuse with regard to hazardous, toxic, and radioactive waste at Former Smoke Area BVZ, Parcel 124(7).

7.0 References

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ATTACHMENT 1

LIST OF ABBREVIATIONS AND ACRONYMS

APPENDIX A

SAMPLE COLLECTION LOGS AND ANALYSIS REQUEST/CHAIN-OF-CUSTODY RECORDS

APPENDIX B

BORING LOGS

APPENDIX C

SURVEY DATA

Appendix C

Survey Data
Former Smoke Area BVZ, Parcel 124(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Northing	Easting	Ground Elevation (ft msl)	Top of Casing Elevation (ft msl)
FTA-124-DEP01	1162964.56	674682.07	866.28	NA
FTA-124-DEP02	1163091.06	674819.98	873.68	NA
FTA-124-GP01	1163144.31	674822.54	881.56	NA
FTA-124-GP02	1163010.50	674763.54	868.22	NA
FTA-124-SW/SD01	1162436.52	674536.12	857.79	NA
FTA-124-SW/SD02	1162740.16	674069.90	851.61	NA
FTA-124-SW/SD03	1163575.16	673692.59	837.92	NA

Horizontal coordinates referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983 (NAD83).

Elevations referenced to the North American Vertical Datum of 1988 (NAVD88).

ft msl - Feet mean sea level
NA - Not applicable, temporary well not installed.

APPENDIX D

SUMMARY OF VALIDATED ANALYTICAL DATA

APPENDIX E

DATA VALIDATION SUMMARY REPORT

ATTACHMENT A

DATA VALIDATION QUALIFIER ENTRY VERIFICATION REPORT

APPENDIX F

SUMMARY STATISTICS FOR BACKGROUND MEDIA, FORT McCLELLAN, ALABAMA

List of Abbreviations and Acronyms (Continued)

sc	clayey sands; sand-clay mixtures
Sch.	schedule
SD	sediment
SDG	sample delivery group
SDZ	safe distance zone; surface danger zone
SEMS	Southern Environmental Management & Specialties, Inc.
SFSP	site-specific field sampling plan
SGF	standard grade fuels
SHP	installation-wide safety and health plan
SI	site investigation
SL	standing liquid
sm	silty sands; sand-silt mixtures
SM	Serratia marcescens
SOP	standard operating procedure
sp	poorly graded sands; gravelly sands
SP	sump pump
Sr-90	strontium-90
Ss	stony rough land, sandstone series
SS	surface soil
SSC	site-specific chemical
SSHO	site safety and health officer
SSHP	site-specific safety and health plan
SSSL	site-specific screening level
STB	supertropical bleach
STEL	short-term exposure limit
STOLS	Surface Towed Ordnance Locator System®
Std. units	standard units
SU	standard unit
SVOC	semivolatile organic compound
SW	surface water
SW-846	U.S. EPA *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*
SZ	support zone
TAL	target analyte list
TAT	turn around time
TB	trip blank
TCA	trichloroethane
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofurans
TCE	trichloroethene
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TDGCL	thiodiglycol
TDGCLA	thiodiglycol chloroacetic acid
TERC	Total Environmental Restoration Contract
TIC	tentatively identified compound
TLV	threshold limit value
TN	Tennessee
TOC	top of casing; total organic carbon
TPH	total petroleum hydrocarbons
TRADOC	U.S. Army Training and Doctrine Command
TRPH	total recoverable petroleum hydrocarbons
TWA	time weighted average
UCL	upper confidence limit
UCR	upper certified range
'U'	not detected above reporting limit
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAEC	U.S. Army Environmental Center
USAEHA	U.S. Army Environmental Hygiene Agency
USACMLS	U.S. Army Chemical School
USAMPS	U.S. Army Military Police School
USATEU	U.S. Army Technical Escort Unit
USATHAMA	U.S. Army Toxic and Hazardous Material Agency
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
UXO	unexploded ordnance
VOA	volatile organic analyte
VOC	volatile organic compound
VOH	volatile organic hydrocarbon
VQlfr	validation qualifier
VQual	validation qualifier
VX	nerve agent (O-ethyl-S-[diisopropylaminoethyl]-methylphosphonothiolate)
Weston	Roy F. Weston, Inc.
WP	installation-wide work plan
WS	watershed
WSA	Watershed Screening Assessment
WWI	World War I
WWII	World War II
XRF	x-ray fluorescence
yd^3	cubic yards

SAIC – Data Qualifiers, Codes and Footnotes, 1995 Remedial Investigation

N/A – Not analyzed

ND – Not detected

Boolean Codes

LT – Less than the certified reporting limit

Flagging Codes

9 – Non-demonstrated/validated method performed for USAEC

B – Analyte found in the method blank or QC blank

C – Analysis was confirmed

D – Duplicate analysis

I – Interfaces in sample make quantitation and/or identification to be suspicious

J – Value is estimated

K – Reported results are affected by interfaces or high background

N – Tentatively identified compound (match greater than 70%)

Q – Sample interference obscured peak of interest

R – Non-target compound analyzed for but not detected (GC/MS methods)

S – Non-target compound analyzed for and detected (GC/MS methods)

T – Non-target compound analyzed for but not detected (non GC/MS methods)

U – Analysis in unconfirmed

Z – Non-target compound analyzed for and detected (non-GC/MS methods)

Qualifiers

J – The low-spike recovery is low

N – The high-spike recovery is low

R – Data is rejected

List of Abbreviations and Acronyms *(Continued)*

GW	groundwater
gw	well-graded gravels; gravel-sand mixtures
HA	hand auger
HCl	hydrochloric acid
HD	distilled mustard
HDPE	high-density polyethylene
Herb.	herbicides
HNO_3	nitric acid
hr	hour
H&S	health and safety
HSA	hollow-stem auger
HTRW	hazardous, toxic, and radioactive waste
'I'	out of control, data rejected due to low recovery
ICAL	initial calibration
ICB	initial calibration blank
ICP	inductively-coupled plasma
ICS	interference check sample
ID	inside diameter
IDL	instrument detection limit
IDLH	immediately dangerous to life or health
IDW	investigation-derived waste
IMPA	isopropylmethyl phosphonic acid
in.	inch
Ing	ingestion
Inh	inhalation
IP	ionization potential
IPS	International Pipe Standard
IRDMIS	Installation Restoration Data Management Information System
ISCP	Installation Spill Contingency Plan
IT	IT Corporation
ITEMS	IT Environmental Management System ™
'J'	estimated concentration
JeB2	Jefferson gravelly fine sandy loam, 2 to 6 percent slopes, eroded
JeC2	Jefferson gravelly fine sandy loam, 6 to 10 percent slopes, eroded
JfB	Jefferson stony fine sandy loam, 0 to 10 percent slopes have strong slopes
K	conductivity
L	lewisite; liter
LC_{50}	lethal concentration for 50 percent of population tested
LD_{50}	lethal dose for 50 percent of population tested
l	liter
LCS	laboratory control sample
LEL	lower explosive limit
LT	less than the certified reporting limit
max	maximum
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mh	inorganic silts, micaceous or diatomaceous fine, sandy or silt soils
MHz	megahertz
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
min	minimum
MINICAMS	miniature continuous air sampling system
ml	inorganic silts and very fine sands
mL	milliliter
mm	millimeter
MM	mounded material
MOGAS	motor vehicle gasoline
MPA	methyl phosphonic acid
MR	molasses residue
MS	matrix spike
mS/cm	millisiemens per centimeter
MSD	matrix spike duplicate
msl	mean sea level
MtD3	Montevallo shaly, silty clay loam, 10 to 40 percent slopes , severely eroded
mV	millivolts
MW	monitoring well
N/A	not applicable; not available
NAD	North American Datum
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
ND	not detected
NE	no evidence; northeast
NFA	No Further Action
ng/L	nanograms per liter
NGVD	National Geodetic Vertical Datum
NIC	notice of intended change
NIOSH	National Institute for Occupational Safety and Health
No.	number
NOAA	National Oceanic and Atmospheric Administration
NR	not requested
ns	nanosecond
N-S	north to south
nT	nanotesla
NTU	nephelometric turbidity unit
O&G	oil and grease
OD	outside diameter
OE	ordnance and explosives
oh	organic clays of medium to high plasticity
ol	organic silts and organic silty clays of low plasticity
OP	organophosphorus
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OWS	oil/water separator
oz	ounce
PAH	polynuclear aromatic hydrocarbon
Parsons	Parsons Engineering Science, Inc.
Pb	lead
PCB	polychlorinated biphenyl
PCE	perchloroethene
PCP	pentachlorophenol
PDS	Personnel Decontamination Station
PEL	permissible exposure limit
Pest.	pesticide
PG	professional geologist
PID	photoionization detector
PkA	Philo and Stendal soils local alluvium, 0 to 2 percent slopes
POL	petroleum, oils, and lubricants
PP	peristaltic pump
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PPMP	Print Plant Motor Pool
ppt	parts per thousand
PSSC	potential site-specific chemical
pt	peat or other highly organic silts
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QAP	installation-wide quality assurance plan
QC	quality control
QST	QST Environmental Inc.
qty	quantity
Qual	qualifier
'R'	rejected; resample
RCRA	Resource Conservation and Recovery Act
RDX	cyclonite
ReB3	Rarden silty clay loams
REG	field sample
REL	recommended exposure limit
RFA	request for analysis
RI	remedial investigation
RL	reporting limit
RPD	relative percent difference
RRF	relative response factor
RSD	relative standard deviation
RTK	real-time kinematic
SAD	South Atlantic Division
SAE	Society of Automotive Engineers
SAIC	Science Applications International Corporation
SAP	installation-wide sampling and analysis plan

List of Abbreviations and Acronyms

2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4,5-TP	silvex
3D	3D International Environmental Group
Abs	skin absorption
AC	hydrogen cyanide
AcB2	Anniston and Allen gravelly loams, 2 to 6 percent slopes, eroded
AcC2	Anniston and Allen gravelly loams, 6 to 10 percent slopes, eroded
AcD2	Anniston and Allen gravelly loams, 10 to 15 percent slopes, eroded
AcE2	Anniston and Allen gravelly loams, 15 to 25 percent slopes, eroded
ACGIH	American Conference of Governmental Industrial Hygienists
ADEM	Alabama Department of Environmental Management
AEL	airborne exposure limit
AHA	ammunition holding area
AL	Alabama
amb.	amber
ANAD	Anniston Army Depot
APT	armor-piercing tracer
ASP	ammunition supply point
ASR	Archives Search Report
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
'B'	Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero)
BCT	BRAC Cleanup Team
BEHP	bis(2-ethylhexyl)phthalate
BFB	bromofluorobenzene
BG	Bacillus globigii
bgs	below ground surface
BHC	betahexachlorocyclohexane
bkg	background
bls	below land surface
BOD	biological oxygen demand
BRAC	Base Realignment and Closure
Braun	Braun Intertec Corporation
BTEX	benzene, toluene, ethyl benzene, and xylenes
BTOC	below top of casing
BW	biological warfare
BZ	breathing zone; 3-quinuclidinyl benzilate
C	ceiling limit value
Ca	carcinogen
CCAL	continuing calibration
CCB	continuing calibration blank
CD	compact disc
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CESAS	Corps of Engineers South Atlantic Savannah
CG	carbonyl chloride (phosgene)
CFC	chlorofluorocarbon
ch	inorganic clays of high plasticity
CHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
CK	cyanogen chloride
cl	inorganic clays of low to medium plasticity
Cl.	chlorinated
CLP	Contract Laboratory Program
CN	chloroacetophenone
CNB	chloroacetophenone, benzene, and carbon tetrachloride
CNS	chloroacetophenone, chloropicrin, and chloroform
Co-60	cobalt-60
COC	chain of custody
COE	Corps of Engineers
Con	skin or eye contact
CRL	certified reporting limit
CRZ	contamination reduction zone
Cs-137	cesium-137
CS	ortho-chlorobenzylidene-malononitrile
CSEM	conceptual site exposure model
ctr.	container
CWA	chemical warfare agent
CWM	chemical warfare material; clear, wide mouth
CX	dichloroformoxime
D	duplicate; dilution
DANC	decontamination agent, non-corrosive
°C	degrees Celsius
°F	degrees Fahrenheit
DCE	dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DEH	Directorate of Engineering and Housing
DEP	depositional soil
DI	deionized
DIMP	di-isopropylmethylphosphonate
DMMP	dimethylmethylphosphonate
DOD	U.S. Department of Defense
DP	direct-push
DPDO	Defense Property Disposal Office
DPT	direct-push technology
DQO	data quality objective
DRMO	Defense Reutilization and Marketing Office
DRO	diesel range organics
DS	deep (subsurface) soil
DS2	Decontamination Solution Number 2
E&E	Ecology and Environment, Inc.
EBS	environmental baseline survey
Elev.	elevation
EM	electromagnetic
EM31	Geonics Limited EM31 Terrain Conductivity Meter
EM61	Geonics Limited EM61 High-Resolution Metal Detector
EOD	explosive ordnance disposal
EODT	explosive ordnance disposal team
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EPIC	Environmental Photographic Interpretation Center
ER	equipment rinsate
ESE	Environmental Science and Engineering, Inc.
ESV	ecological screening value
Exp.	explosives
E-W	east to west
EZ	exclusion zone
FB	field blank
FD	field duplicate
FedEx	Federal Express, Inc.
FFE	field flame expedient
Fil	filtered
Flt	filtered
FMP 1300	Former Motor Pool 1300
Foster Wheeler	Foster Wheeler Environmental Corporation
Frtn	fraction
FS	field split
ft	feet
ft/ft	feet per foot
FTA	Fire Training Area
FTMC	Fort McClellan
g	gram
G-856	Geometrics, Inc. G-856 magnetometer
G-858G	Geometrics, Inc. G-858G magnetic gradiometer
gal	gallon
gal/min	gallons per minute
GB	sarin
gc	clay gravels; gravel-sand-clay mixtures
GC	gas chromatograph
GC/MS	gas chromatograph/mass spectrometer
GFAA	graphite furnace atomic absorption
gm	silty gravels; gravel-sand-silt mixtures
gp	poorly graded gravels; gravel-sand mixtures
gpm	gallons per minute
GPR	ground-penetrating radar
GPS	global positioning system
GS	ground scar
GSA	General Services Administration
GSBP	Ground Scar Boiler Plant
GSSI	Geophysical Survey Systems, Inc.
GST	ground stain